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UNH Scientists Present Findings From Huge Summer 2004 Air Quality Study At American Geophysical Union Meeting In San Francisco

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DURHAM, N.H. -- University of New Hampshire scientists and students affiliated with the joint UNH-NOAA (National Oceanic and Atmospheric Administration) AIRMAP project contributed some 40 oral and posters presentations at the weeklong annual meeting of the American Geophysical Union (AGU) that ended last Friday in San Francisco.

At the AGU meeting – one of the largest science gatherings in the world, with over 12,000 in attendance for this year's event – topics presented by UNH scientists and students ranged from advancing our understanding of sophisticated chemical mechanisms that produce ground-level ozone in the atmosphere to insights into the largely unknown area of nighttime chemistry, which plays a larger-than-expected role in regional air quality.

Much of the data presented by UNH faculty, staff, and students was the culmination of research from the six-week-long, largest-ever air quality field experiment based out of seacoast New Hampshire that took place in the summer of 2004. The experiment, known as the International Consortium for Atmospheric Research on Transport and Transformation, or ICARTT, involved five countries, universities and government agencies – including NOAA and NASA – and hundreds of scientists.

The massive ICARTT study was based in N.H. due to AIRMAP's five state-of-the-art atmospheric monitoring observatories located strategically around the region. The observatories served as the foundation for the study by providing a continuous, long-term record to put into context the snapshots of air quality gathered by the mobile platforms, which included a series of "smart balloons" that changed their vertical position in columns of air while sampling for ozone levels using a miniature sensor developed at UNH's Institute for the Study of Earth, Oceans, and Space (EOS).

Funding for AIRMAP and the UNH role in ICARTT has been facilitated by the efforts of U.S. Senator Judd Gregg (R-NH) who, as former chairman of the Senate Appropriations Subcommittee, has been instrumental in securing funds for the multi-million dollar atmospheric research program.

Says Robert Talbot, AIRMAP's director and a participant in the AGU proceedings, "The

AIRMAP program at UNH was a driving force for ICARTT on the national and international levels and is now leading the scientific thrust in several areas. UNH students have been full participants in the whole process. This has occurred not only at the graduate level, but undergraduates were deeply involved along the way with the AIRMAP measurements and the historic smart balloon flight that crossed 7,000 kilometers of ocean measuring ozone with unprecedented spatial resolution."

During the ICARTT campaign, the UNH/NOAA smart balloon platform measured the highest concentrations of ozone ever reported at low altitudes over the North Atlantic – levels that easily exceeded U.S. air quality standards. The work also showed how urban pollution plumes can remain intact and travel inter-continental distances to deliver high pollutant levels thousands of miles away from the original source.

In an AGU presentation related to this work, NOAA scientists presented data showing extremely large amounts of highly reactive nitrogen compounds in urban plumes leaving the U.S. East Coast. The plumes' associated chemical soup is the likely reason for the very high levels of ozone measured by the smart balloon platform. These nitrogen compounds are usually associated with automobile and truck traffic along the urban corridor in the Northeast.

Over the course of the AGU meeting, AIRMAP scientists, in addition to presenting ICARTT data, detailed results of closely associated Environmental Protection Agency-funded work they're doing to project future climate over North America using of a one-of-a-kind regional climate model developed by UNH scientist Ming Chen. The model results predict a progressive migration of current, indigenous vegetation types northward during the 21st century, as well as an increase in heavy precipitation events – with increased periods of drying and flooding across most of the U.S.

Says Talbot, "This work indicates that our classic New England climate will slowly shift over the next century toward a more southern-style warmer environment accompanied by fewer overall precipitation events but more intense episodic storms."

AIRMAP scientists, lead by professor Huiting Mao, presented results showing that changes in biogenic (from trees and plants) emissions under the higher carbon dioxide concentrations predicted to be present near the end of the 21st century should result in increased ground-level ozone concentrations. In addition, AIRMAP and NASA scientists teamed up during ICARTT to provide evidence for a terrestrial source of a compound (methyl iodide) believed previously to only come from degassing of the ocean. This new data presented by Ruth Varner shows that terrestrial ecosystems are a major source to the global atmosphere of extremely reactive chemical species known as halogen radicals that can greatly speed up the ozone and aerosol formation process.

AIRMAP graduate student Jesse Ambrose presented one of the first analyses of nighttime chemistry of ozone and nitrogen compounds over the ocean at Appledore Island – six miles off the NH coast and home to one of the AIRMAP observatories. Says Ambrose, "We are beginning to link the 'dark' and 'day' chemistries and provide key insight into important controls on regional air quality in New England. That is, the chemistry continues around the clock but in different ways." Previous work has mainly considered the chemistry during the daytime since it is driven by the presence of sunlight.

AGU is a worldwide scientific community that advances "the understanding of Earth and space for the benefit of humanity" by informing and educating the public and by demonstrating the relevance of geophysical research to society, by fostering a strong and diverse Earth and space science workforce, and by providing a basis for the development of public policy activities

worldwide.